

PHOENIX MARS LANDER

Add-on for Orbiter 2016 (v.160828)

REQUIREMENTS

Launch scenario requires "Delta2 and SLC17" add-on:

<https://www.orbithangar.com/searchid.php?ID=7124>

INSTALLATION

Extract all files to the root of your Orbiter program directory, preserving the directory structure. This should NOT overwrite anything in the standard Orbiter package.

WHAT'S IN THIS ADD-ON?

The Phoenix Mars lander spacecraft with automatic EDL sequence. Launch, post-launch and Mars approach scenarios.

SCENARIOS

Scenarios are in the Scenarios/Phoenix Mars Lander/ folder.

1. *Phoenix Launch*

Phoenix launched 04 August 2007, 09:26:34 UTC, from LC-17A on a Delta II 7925.

93.5° launch azimuth, circular parking orbit at ~185 km altitude.

Press [V] at T-10s to activate the autopilot to parking orbit. Use the MFD of choice to plan the final ejection burn to Mars.

2. *Phoenix Post Launch* - leaving Earth, on course for Mars.

3. *Phoenix Mars Approach* - about 1hr before EDL and landing.

MISSION OVERVIEW

NASA's first Mars Scout class mission, designed to investigate the Martian Arctic environment. The Phoenix lander was equipped with a science payload suitable for gathering data about the geological history of water and possible biological history of the Martian surface.

Phoenix was launched on 04 August 2007, 09:26:34 UTC, on a Delta 7925 launch vehicle. It landed successfully on Mars on 25 May 2008, 23:38:44 UTC, and continued operations until its last communication with Earth on 02 November 2008.

More info:

<http://phoenix.lpl.arizona.edu/index.php>

[http://en.wikipedia.org/wiki/Phoenix_\(spacecraft\)](http://en.wikipedia.org/wiki/Phoenix_(spacecraft))

PHOENIX ADD-ON SPECS

Cruise Stage	82 kg	Fuel ISP	2500 Ns/kg
Backshell	110 kg	RCS Engines	4.5 N each (x 4)
Heatshield	62 kg	TCM Engines	22.5 N each (x 4)
Lander	343 kg	Lander Descent Engines	302.75 N each (x12)
Fuel Mass	67 kg		

The Lander carries 67kg of Hydrazine fuel (ISP 2500 Ns/kg) which is used for Trajectory Correction Maneuvres during the cruise phase and for controlling Lander velocity during the final landing phase. There are four 4.5N Linear RCS thrusters and four 22.5N Trajectory Correction Maneuvre thrusters which thrust in the +Z axis. The Rotation RCS thrusters are not balanced and will give a small dV in the +Z axis. For the Lander's final descent, there are twelve 302.75N thrusters mounted on the bottom of the Lander.

SPACECRAFT CONTROLS

Cruise Phase

The RCS attitude thrusters and TCM thrusters are controlled by the normal keyboard commands for RCS thrusters and Main Engine respectively. Translation RCS in +Z direction only.

The HUD display shows the total available dV, and also the available dV for cruise phase TCM's without using fuel required for landing.

[K] = Deploy Cruise Module Solar Panels

[J] = Jettison Cruise Module (at end of Cruise Phase - 1000km alt. Mars)

Entry Descent and Landing (EDL) Phase

The entire EDL sequence is automatic:

Parachute opens 12.6km

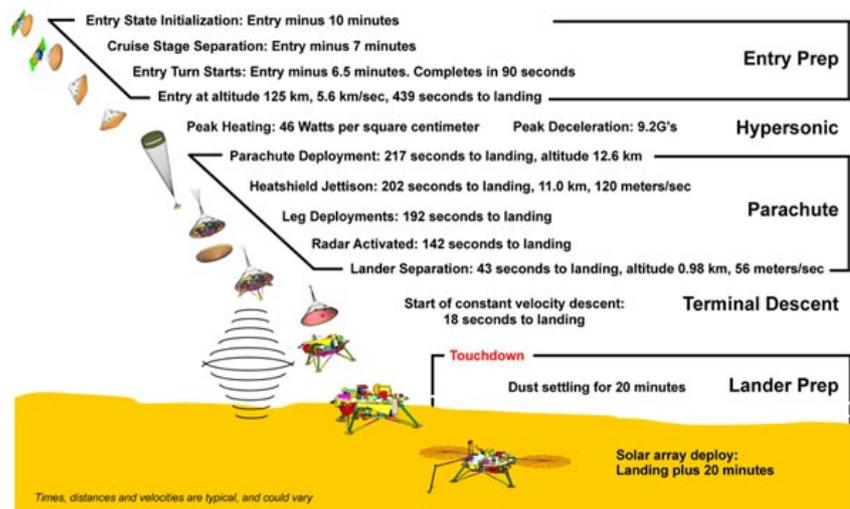
Heatshield jettisoned 11km

Lander legs deployed 10km

Backshell and Parachute
jettisoned 800m

Lander Engines Throttle Up and
"Backshell Avoidance Maneuvre"
760m

Constant velocity 1.5m/s descent
9m



LANDER CONTROLS

The final powered descent of the Lander after parachute jettison at 800m is controlled by it's onboard autopilot. The autopilot can be overridden by pressing [M] for manual control.

If control is switched to manual, the twelve Lander Descent Engines are controlled by the normal keyboard commands for Main Engine [NumPad + or -].

Pitch, Roll and Yaw can be controlled by the normal keyboard commands for rotation RCS [NumPad 1 to 9]

(Pitch and Roll are achieved by differential throttle of the Lander Descent Engines, Yaw is achieved by the RCS thrusters).

[M] = Manual Override Descent Engines

[G] = Deploy MET, SSI, LIDAR, Robotic Arm cover

[K] = Deploy Solar Panels

[D] = Activate LIDAR laser

[C] = Rotate SSI camera

Robotic Arm:

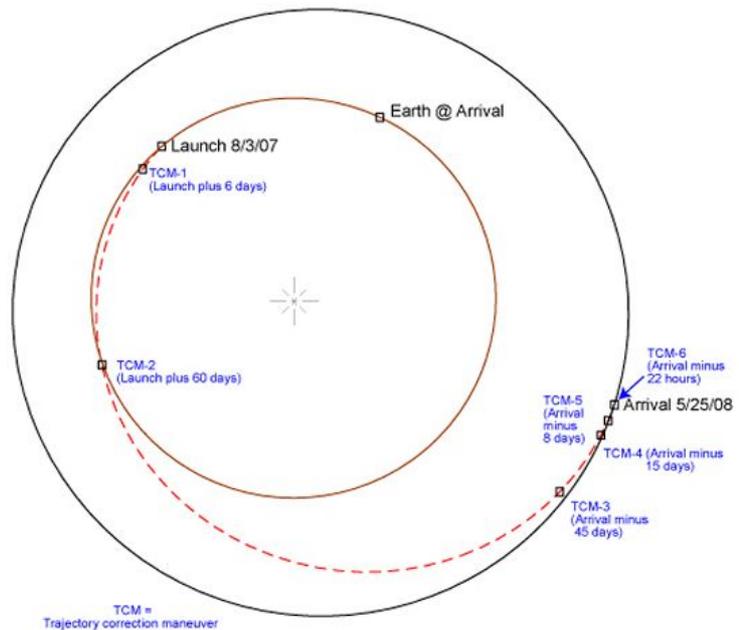
[B] or [shift + B] = Deploy/Retract Arm

[N] or [shift + N] = Arm Elbow

[V] or [shift + V] = Rotate Arm Shoulder

TRAJECTORY

The Phoenix spacecraft arrived at Mars on 25 May 2008 after a 9 month cruise. The lander touched down at 23:38:44 UTC, at Lat. 68.22 N, Long. 125.75° W, heading 180°.



QUICK REFERENCE

Spacecraft Controls – Cruise

[K] = Open Cruise Module Solar Panels

[J] = Jettison Cruise Module/Solar Panels (at 1000km alt Mars)

Lander Controls – Descent/Landed

[M] = Descent Autopilot On/Off

[K] = Deploy Solar Panels

[G] = Deploy MET, SSI, LIDAR, Robotic Arm cover

[D] = Activate LIDAR laser

[C] = Rotate SSI camera

Robotic Arm:

Hold down [B] or [Shift + B] = Deploy/Retract Robotic Arm

Hold down [N] or [Shift + N] = Open/Close Robotic Arm Elbow

Hold down [V] or [Shift + V] = Rotate Robotic Arm Shoulder

Timeline

Launch 93.5 Azimuth, 185km parking orbit, 04 August 2007, 09:26:34 UTC, MJD 54316.3934

Landing Lat. 68.22 N, Long. 125.75° W, Hdg. 180°, 25 May 2008, 23:38:44 UTC, MJD 54611.9847

IMFD "Base Approach" settings

Ref. Mars

Lat. 68.22°

Long. -125.75°

Alt. 120000m

ReA 12.5°

Ant. 10.4°

Happy Orbits :-)

BrianJ

Nov 2017